

Synopsis of the Fishes of the Peruvian Amazon, obtained by Professor Orton during his Expeditions of 1873 and 1877.

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The present paper consists of a catalogue of one hundred and twenty species of fishes which were obtained by the late Professor James Orton, from the head streams of the Amazon. The localities from which the specimens were derived, are the following: Cuzco, on the Urubamba near the head of the Ucayale; Moyabamba and Balsa Puerto on or near the lower course of the Huallaga; Nauta on the Marañon at the mouth of the Ucayale, and Pebas below the mouth of the Napo. The larger part of the collections of 1873 came from Nauta, while those of 1877 were partly obtained near Pebas. The specimens from the Urubamba are the only ones taken at a great elevation, that of 11,000 feet. A recapitulation will be given at the close of the Catalogue. The collections contain numerous species previously known, as well as a number of interesting novelties.

HOLOSTOMI.

SYMBRANCHIDÆ.

1. SYMBRANCHUS MARMORATUS Bloch.
Coll. 1873.

NEMATOGNATHI.

HYPOPHTHALMIDÆ.

2. HYPOPHTHALMUS EDENTATUS Spix.
Coll. 1873.
3. HYPOPHTHALMUS PERPOROSUS, sp. nov.

Established on a rather large specimen in good preservation. Radii; D. I. 6; A. 67; V. I. 5. The dorsal fin is small, and is situated 35 mm. nearer the end of the muzzle than the base of the superior fulcra of the caudal fin; it originates above the seventh ray of the anal fin. The extremities of the ventrals do not extend beyond those of the pectorals. The spine of the latter is very weak, although longer than that of the dorsal, and is one-third the length of the head. The head enters the length minus the caudal fin four and one-seventh times, and is just equal to the depth of the body at the anterior part of the anal fin. The eye is one thirteenth the length of the head, and one-sixth the length of that part of the head anterior to it. The fissure continued from the canthus oris extends to below its center. One eye is a little more elevated than the other, the one having some inferior range, the other none. The maxillary barbels commence nearer to the angle of the mouth than to the base of the posterior mental barbels, and extend to a little beyond the base of the ventral fin. The mental barbels are on nearly a transverse line, and are broadly margined posteriorly; they

are sub-equal in length, and when extended reach nearly to the opercular border. A peculiarity of this species, which I do not find in the *H. edentatus*, is the porosity of the skin. A series of pores extends along each border of each myocomma, forming double rows, extending from the dorsal to the ventral line 3 mm. apart. The pores in each row are from one to two millimeters apart.

The general color of this species is silvery, with the head and dorsal region lead colored. Total length M. .500; of head .108; to the line of the base of the anal .160; to base of caudal fin .435.

Probably from Nauta.

SILURIDÆ.

4. SORUBIM LIMA Bl., Schn.

Coll. 1873-77.

5. PLATYSTOMA FASCIATUM Linn. From Nauta, coll. 1873.

I find the anal rays of the specimen to count II-9; Dr. Günther gives 14.

6. HEMISORUBIM PLATYRHYNCHUS Cuv. Val.

Coll. 1877.

7. PHRACTOCEPHALUS HEMLIPTERUS Schn.

Coll. 1877.

8. PSEUDORHAMDIA PISCATRIX Cope, Proceed. Amer. Philos. Soc., 1870, p. 569.

Coll. 1877.

9. PIMELODUS HUMILIS Gthr., Catal. Fishes, Brit. Mus. v 129.

A specimen of about the size of those described by Dr. Günther agrees with them very closely in all important respects. There are some differences, however, which should be noted, especially since the typical specimens are said to have come from Venezuela. In the latter the distance between the dorsal fins is said to equal two-thirds the length of the adipose fin: in my specimen this space equals two-fifths the length of the adipose. The diameter of the eye in the former is described as one-half the width of the interorbital space; in the Peruvian specimen, the diameter of the eye is a little more than one-third the same dimension. There is a dark cloud at the base of the rayed dorsal fin, whose superior border is abruptly contrasted with the paler color above it. The anterior part of caudal region is a little more elevated than the dorsal region.

From Rioja, near Moyabamba, coll. of 1873.

10. PIMELODUS BATHYURUS, sp. nov.

Head covered with thin skin, and not granular, but somewhat ridged above. Supraoccipital process long and narrow, not reaching the basal bone of the dorsal spine; adipose fin contained 4.3 times in the length minus the caudal fin. The caudal portion of the fish is considerably deeper than the abdominal, entering the length (less the caudal fin) six and three-tenth times. The head (to the opercular border) enters the same three and one-half times; it is flat and rather elongate, and the mandible projects beyond the

premaxillary border. The eye's diameter is just half the interorbital width. The maxillary barbels exceed the length of the fish; and the posterior mandibulars reach to a point below the middle of the dorsal fin.

Radial formula ; D. I. 6 ; A. 9. Dorsal spine very slender, smooth, and not so long as the pectoral spine. The latter is as long as from the premaxillary border to the middle of the orbit ; it is finely serrate on both edges. Operculum roughened with radiating lines ; supraoccipital process six times as long as wide. Total length M. .070, interorbital width .007 ; length of base of rayed dorsal .008. Color uniform plumbeous.

Collection of 1877 ; two specimens.

11. *PIMELODUS OPHTHALMICUS*, sp. nov.

Head covered with a thin skin above which is involved in osseous wrinkles on the post frontal region. Supraoccipital process four times as long as wide, reaching the basal bone of the dorsal spine. Length of adipose fin contained 2.8 times in the length minus the caudal fin. Form quite slender ; the greatest depth (which is at the middle of the dorsal fin) entering the length (minus the caudal) 6.5 times. The length of the head enters the same 4.75 times. The maxillary barbels reach to the middle of the anal fin, and the posterior mentals to the middle of the pectoral fin.

The eye is large, entering the length of the head three and three-eighth times, and exceeding the interorbital width by 2 mm. The upper lip projects a little beyond the lower. The two dorsal fins are separated by a space about equal to three-fourths the base of the anterior fin. The latter is higher than the depth of the body, and nearly equal to the length of the head ; the spine is slender, and finely dentate on both edges. The pectoral spine is finely serrate on both edges and is nearly five-sevenths the length of the head. Radial formula ; D.I. 6 ; A. 13 ; V. 6 ; P. I. 8. Humeral process extending to middle of pectoral spines, striate grooved. Axillary pore present. Color brown lead-color ; top of head blackish ; dorsal fin brown at base, then clear, then blackish. Total length M. .145.

Coll. of 1873.

This species belongs to the group with *Pimelodus cristatus*, *P. elongatus*, *P. agassizii*, *P. vassalii*, etc. It appears to approach most nearly the first named, but that fish has, according to the descriptions, fifteen anal rays, and the mental barbels extend beyond the extremity of the pectoral fins. Günther also states that its dorsal fin is nearly twice as high as long, which is not the case in my specimen, and the dorsal spine is not so long in the latter, being only three-fourths as long as the head instead of equal to it. The *Pimelodus cyanostigma* (*Rhamdia cyanostigma* Cope, Proceed. Amer. Philos. Soc. 1870, p. 569) is an allied species ; but it has a shorter adipose fin, which enters the length three and one-fourth times, and which is separated from the rayed dorsal by a space equal to the length of the latter. Its maxillary barbels are also longer, extending to the end of the adipose fin.

12. *PIMELODUS BUFONIUS* Cuv. Val.

Coll. 1873-1877.

13. CALLOPHYSUS LATERALIS Gill.

Coll. 1877.

14. AGENIOSUS BREVIFILIS Cuv. Val.

Coll. 1873.

15. EUANEMUS NUCHALIS Spix.

Coll. 1873-1877.

16. EUANEMUS BRACHYURUS, sp. nov.

A single specimen of this species compared with three of the *E. nuchalis*, exhibits the following differential characters: With the head and abdomen of about the same length, the caudal region is only two-thirds as long; hence the anal fin is shorter, and is supported by fewer rays. The dorsal spine is materially longer and stronger. The head is much wider than in a *E. nuchalis* of the same total length. The teeth are much more numerous, forming wide bands on the dentaries, and a well-defined premaxillary band. The humeral process is naked; in *E. nuchalis* it is covered by a soft skin.

The depth at the first anal ray is one-sixth the length less the caudal fin. The length of the head enters the same 4.8 times. The length of the eye enters the head three times, and the interorbital width, one and two-third times. The dorsal spine is weakly serrate behind, smooth in front. The pectoral spine is strongly serrate behind, and is smooth in front; it is about as long as the head, and one quarter longer than the dorsal spine. Radii D. 1.7; C. $\pm 17 \pm$; A. 37; V. 14, the first ray enlarged; P. I. 12. The inner rays of the ventral fins adhere to the integument of the abdomen, but not to those of the opposite fin. The ventrals are wider than the pectorals and nearly reach the anal fin; the pectoral spines do not reach the base of the ventrals. The humeral process is smooth, and reaches the end of the basal fourth of the spine. The maxillary barbels reach nearly to the extremity of the pectoral spine, while the anterior mentals reach to the base of the same.

Total length. M. .145; of head .025; do. to base of anal fin .070; of base of anal fin .040. Lead-colored, sides of abdomen silvery; base of caudal fin blackish, the color extending into the superior and longer lobe.

17. AUCHENIPTERUS BREVI-BARBS, sp. nov.

Form robust; length of head entering total, without caudal fin, a little over four times; the depth of the body at the ventral fins entering the same five times. Head above coarsely granular, frontal fontanelle reduced to a small round hole. Mandible projecting a little. Anterior mental barbel as long as three diameters of the eye; the posterior not reaching the line of the posterior border of the operculum. Maxillary barbel reaching to the middle of the pectoral spine. Diameter of eye less than one sixth the interorbital width. Humeral process half as long as pectoral spine. Lateral posttemporal process decurved so as to be nearly in contact with the middle of the humeral process.

Radial formula: D. I. 5; P. I. 6; V. 7; A. 22-3. Dorsal spine very ro-

bust, denticulated in front; pectoral spines twice as long, equaling (axial) length of head, robust, and serrate on both edges. Their extremities extend behind the line of the last dorsal ray, but do not reach the origin of the ventral fin. Caudal fin truncate with a slight obliquity inwards and downwards. Total length M. .230; of dorsal spine .023; of pectoral fin .045. Color above blackish, below brown; lower part of sides, chiefly behind pectoral fin with dark spots on the brown ground.

This robust species is related to such as the *A. obscurus* Gthr., but differs from them in the short beards, fewer fin rays and other characters.

Coll. 1877.

18. *AUCHENIPTERUS ISACANTHUS*, sp. nov.

Head rather wide, not steeply shelving at the sides posteriorly, and finely rugose above, without a dermal layer, so that the segmentation of the bones is distinctly visible. Its length enters the total (less caudal fin) four times; which is an expression of the robust form of the fish. The body is highest at the front of the anal fin. Radii D. I. 5; A. 22; V. 7. Dorsal and pectoral spines of equal length and a little shorter than the length of the head, both serrate on both edges, the dorsal much the more finely. Eye obscure; operculum covered with smooth skin. Anterior mental barbels about equal to diameter of orbit; maxillary barbels reaching end of pectoral spine. Mandible projecting a little beyond premaxillary. Humeral process reaching beyond the middle of the pectoral spine, its surface coarsely striate, the striæ nodular. No thoracic dermo-ossification. Anal fin with nearly straight free border. Total length .085; of head above .025; of dorsal spine .016; interorbital width .011. Uniform lead color; dorsal fin with a black spot above.

This species is much smaller than the last, and very different in many respects, although it agrees with it in the rugosity of the head. It has, however, a large fontanelle open in front, while that of the *A. brevibarbis* is very small, and completely enclosed.

Two specimens; Coll. 1877.

19. *CENTROMOCHLUS HECKELII* Filippi.

Coll. 1877.

20. *EPAPTERUS DISPILURUS*, gen. et sp. nov.

Char. Gen. Group *Doradinae* of Gunther, with anterior dorsal fin in front of the ventrals, and gill membranes confluent with that of the throat. No adipose fin; soft portion of dorsal rudimental. Six barbels; teeth wanting from jaws and palate. Dorsal and pectoral spines present; ventral fins united to each other and to the middle line of the belly. Anal fin long, distinct from the caudal.

This new genus is related to *Euanemus*, but is distinguished by three characters, viz: (1) absence of adipose fin; (2) absence of teeth, and (3) rudimental soft part of first dorsal fin. The rudimental character of the teeth in *Euanemus nuchalis* offers an approximation to the edentulous condition of *Epapterus*.

Char. Specif. The proportions are elongate and the head is short, entering the length less the caudal fin six times. The anal fin is long, extending far forward, and the greatest depth of the fish is at its anterior part. This is a little more than one-fifth the length (less the caudal fin). The head is narrow, and rises rather steeply to the base of the dorsal spine without interruption. The supraoccipital process is rather wide, and continuous with the basal bone of the dorsal spine. The latter is bifurcate and sends a process outwards and backwards behind the base of the spine. The frontal fontanelle is long, and the head is covered with smooth skin. The eye is large and without free dermal border; its diameter enters the length of the head to the opercular border three and one-third times, and the interorbital width one and two-third times. The superciliary and prefrontal borders are prominent and form together an acute angle. The supraoccipital region is not keeled, but its sides form a steep roof.

Radii D. I.; A. 61; C. + 17 +; V. 15; P. I. 13. The dorsal spine is slender and nearly as long as the pectoral. It is directed somewhat forwards, and is entirely smooth. The caudal fin is notched to half its depth, and is rather small. The ventrals are large, and are united by the entire length of their inner rays. The external or first ray of each, is larger than the others, and the apex of the fin reaches the first anal ray. The closed pectoral spine barely reaches the base of the ventral; it is set with recurved teeth behind, but is smooth in front. The soft part of the fin is contracted and is much smaller than that of the ventral fin. The humeral process is short and smooth and is covered by a smooth skin; the postcoracoid processes are rather long and are very acute at the apex.

The maxillary barbels continue from the extremity of the long maxillary bone to the middle of the pectoral spine; the anterior ventrals, which are very little in advance of the posterior ventrals, reach the base of the same. The eyes have nearly as much inferior as superior range, and the mouth does not extend beyond their anterior angle. Lips equal.

Color in spirits light brown, the dorsal region blackish. A black spot in the middle of each lobe of the tail. Total length M. .125; length of head .019; to the base of anal fin .046; of anal fin .062. Width between bases of pectoral spines .016.

Two specimens from the collection of 1873.

21. *CETOPSIS CANDIRA* Agass.

Coll. of 1877.

22. *RHINODORAS PRIONOMUS* Cope, Proceed. Academy Philada. September 1874, p. 134. *Rhinodoras tiffeanus* Steindachner, Sitzungsberichte Akademie Wiss. Wien, 1875; read January, published? Pl. III.

From Nauta, Coll. 1873.

23. *RHINODORAS NIGER* Valenci.

Coll. 1873. Nauta.

24. *ZATHORAX NAUTICUS* Cope, Proceed. Acad. Phila. 1874, p. 133.

From Nauta.

In some specimens of this species the adipose dorsal fin is wanting,

though generally present. The naked inferior surface of the scapular arch distinguishes this genus from *Doras*, and I now think that the peculiar form of the prefrontal bone has a similar value. The superior and anterior borders of the latter are free and pectinate as in *Physopyxis*.

The *Doras pectinifrons* m. presents the same character, but the scapular arch is covered below by thick skin as in *Doras*. I therefore regard it as representing a genus between the latter and *Zathorax*, which may be called *Agamyxis*. *Doras grypus* m. belongs to *Doras*.

25. *HYPOPTOPOMA BILOBATUM* Cope, Proceed Amer. Philos. Soc. 1870, p. 566.

Coll. of 1873.

26. *HYPOPTOPOMA GULARE*, sp. nov.

This species is more robust than the *H. bilobatum*, and differs in various respects. There are but 21 shields crossed by the middle line of the side instead of 25; the space between the sub-orbital bones and the clavicle is filled with an osseous shield wanting in *H. bilobatum*, and there is no median series of abdominal scuta. As compared with the *H. thoracatum* Günth, this fish exhibits similar proportions, having the head wider in proportion to the length than in *H. bilobatum*. But the scuta of the throat and thorax in *H. thoracatum* are as in *H. bilobatum*, as well as the number of scuta crossing the lateral line. The caudal fin has the lobes sub equal as in *H. bilobatum*.

Radii D. I. 7; A. I. 5; V. I. 5; P. I. 6. Pectoral spine reaching end of ventral spine; dorsal spine not branched at extremity, rather stout, nearly as long as the pectoral, its base 4 mm. nearer end of muzzle than base of caudal fin. Head very flat, quite wide, its width behind orbits about one-fourth the length to the base of the caudal fin; its length to the superior angle of the gill opening, 3.8 times into the same. The spine supporting the adipose fin, stands on the anterior border of the fourth dorso-lateral scute counting from the base of the first superior caudal fulcrum. Some scuta between this point and the last dorsal ray. Each border of the muzzle supports a wide band of segments, within which a narrower band of segments bounds the median wedge-shaped area on each side. Inferior border of end of muzzle prickly; eye with some inferior range. Scuta of head above, and those below as far as vent, finely granular; the others smooth. Color olive brown, each scute of the body, and the three nuchal ones with a pale border within the edge. Caudal with the rays brown, except a wide margin, and a vertical line beyond base, which are pale. The dorsal fin is deep brown at the base, and has some dark spots on its middle. Length M. .105; to base of pectoral fin .028; to base of anal .052; elevation of dorsal spine .021.

Coll. of 1877.

27. *CHLENOTHORAX BICARINATUS*. Gen et sp. nov.

Char. Gen. Callichthyiform fishes with osseous dorsal and pectoral spines, a produced occipital shield, and 9-11 soft rays in the dorsal fin.

The coracoid shields are lateral, and do not cover the abdomino-thoracic region.

This genus is similar to *Gastrodermus* m. excepting in the increased number of dorsal radii, in which it is identical with *Brochis*. It might be called *Brochis* without coracoid breast shield. A synopsis of the species of this group is given below.

Char. Specif. Radii: D. I. 11; A. II. 6; V. 6; P. I. 7. The dorsal and pectoral spines are of sub-equal length and serrate behind only; their length equals the distance from the pupil of the eye to the end of the muzzle. The profile is rather steep; the head is compressed, and the muzzle is produced. The diameter of the eye is a little more than one-fourth the length of the head, is one-half the length of the muzzle, and half the inter-orbital space measured over the convexity. There are two azygous bones between the supra-occipital crest and the first dorsal spine. There are twenty three vertical scuta between the supra-temporal, and the base of the caudal fin; no dorsal or ventral azygous scuta. The postcoracoid plates are nearly smooth and sub-vertical, projecting downwards so as to form an obtuse keel on each side of the belly. Inferior bridge of scapular arch covered with soft skin. Maxillary beard nearly attaining gill fissure; inferior lip broadly reverted, produced into a short barbel on each side. Facial ossification extending one-third the distance to the maxillary; half way to the end of the muzzle, and not enclosing nares. Color olivaceous; top of head darker; fins immaculate. Length M. .059; of head .014; do. to base of ventral fin (axial) .022; to base of anal .035. Length of dorsal spine .011.

Coll. 1877.

A second species of this genus is the *C. semiscutatus* (*Corydoras* Cope, 1872). The species and genera of this group are the following:

BROCHIS Cope, Proc. Ac. Nat. Sci. Phila. 1871. Coracoid shields covering the breast; dorsal soft rays 9-11. The *Callichthys taiosh* Cast. probably belongs to this genus.

B. caruleus Cope, loc. cit. 1872, p. 277.

B. dipterus Cope, loc. cit. 1872, p. 278.

CILEXOTHORAX Cope, supra. Coracoid shield not enclosing the breast and belly; dorsal soft rays 9-11.

C. bicarinatus Cope, supra.

C. semiscutatus Cope, Proceed. Acad. Phila. 1872, p. 280.

This species differs from the *C. bicarinatus* in the horizontally extended coracoid shields, the greater development of the facial ossification, the shorter muzzle, larger eye, and greater relative thickness of the head.

CORYDORAS Lacep. Bleeker; *Hoplisoma* Sws. Coracoid shields enclosing ventral region; dorsal soft rays 6-7.

C. punctatus Lac. Günther, Catal. v. 229.

C. arneus Gill. Günther, l. c.

C. eques Steind. Sitzungsberichte Wien Akademie, 1876 (July), p. 92, Pl.

XII, fig. 3.

GASTRODERMUS Cope. Coracoids not enclosing the ventral region, which is covered with soft skin ; dorsal soft rays 6-7.

G. ambiacus Cope, Proceed. Acad. Phila. 1872, 280.

G. trilineatus Cope, l. c. 281, Pl. VI, fig. 2.

G. acutus Cope, l. c. 281.

G. amphibelus Cope, l. c. 282.

G. armatus Günth. Proceed. Zool. Soc. Lond., 1868, 230, cut.

G. agassizii Steind. loc cit. sup. 90, Pl. XII, f. 2.

G. elegans Steind. l. c. 93.

G. nattereri Steind. l. c. 95, Pl. XI, f. 1.

28. GASTRODERMUS ARMATUS Gthf.

Coll. 1873.

29. GASTRODERMUS AMBIACUS Cope.

Coll. 1873. Nauta.

30. CALLICHTHYS ASPER Quoy. Gainn.

Coll. 1873. Nauta.

31. HOPLOSTERNUM LONGIFILIS Cuv. Val.

Coll. 1873. Nauta.

32. LORICARIA CATAPHRACTA L.

Coll. 1873. The Marañon.

33. LORICARIA ROSTRATA Spix.

Coll. 1873.

34. LIPOSARCUS JEANESIANUS Cope, Proceed. Acad. Phila., 1874, p. 135.

Coll. 1873. Nauta.

35. LIPOSARCUS SCROPHUS Cope, l. c. p. 136.

Coll. 1873. Nauta.

36. PLECOSTOMUS VIRESCENS Cope, l. c. 137.

Coll. 1873.

37. ARGES SABALO Cuv. Val.

Rio Urubamba ; altitude 10,000 feet.

38. TRICHOMYCTERUS DISPAR Tsch. Cope, Proceed. Amer. Philos. Soc., 1877, p. 30.

Sources of the Ucayale at Urubamba, 10,000 feet, and Tinta, 11,400 feet.

39. TRICHOMYCTERUS GRACILIS (?) Cuv. Val., Cope, loc. cit. p. 30.

Tinta, 11,400 feet.

ASPREDINIDÆ.

40. BUNOCEPHALUS MELAS Cope, loc. cit. 1872, p. 132.

Coll. 1873. Nauta.

41. DYSICHTHYS CORACOIDEUS Cope, l. c. p. 133.

Coll. 1873. Nauta.

PLECTOSPONDYLI.

STERNOPYGIDÆ.

42. CARAPUS FASCIATUS Pallas.
Coll. 1873-1877.
43. STERNARCHUS BONAPARTII Castelnau.
Coll. 1877.
44. STERNARCHUS ALBIFRONS Linn.
Coll. 1877.
45. STERNARCHUS SCHOTTI Steindachner.
Coll. 1877.
46. STERNARCHUS BALÆNOPS, sp. nov.

Profile oblique, with a depression between the orbits; snout short, and much narrowed. Lower jaw large, projecting beyond the upper both anteriorly and laterally, enclosing the latter somewhat as in a whalebone whale. The fissure of the mouth is short, only reaching the vertical line from the anterior nostril. Eyes small, without free border, much nearer the snout than the gill opening, one-twelfth the length of the head, which latter enters the length without caudal fin, 8.5 times. The depth at the base of the dorsal thong is equal to the length of the head. Anal radii 171. Scales very large, in only nine longitudinal rows at the base of the dorsal thong. Color olivaceous, with a pale dorsal band which reaches the dorsal thong, and a pale narrow band on each side near the dorsal band. Length M. .165; length to origin of anal .020; length to base of dorsal thong .096.

This species resembles remotely the *S. schottii* of Steindachner, but differs from it and from all the other species in the much enlarged mandible and the large scales.

Coll. 1877.

47. RHAMPHOSTERNARCHUS MACROSTOMA Gthr., Catal. Brit. Mus. VIII,
p. 4.
Coll. 1877.
48. RHAMPHICHTHYS PANTHERINUS Castelnau.
Coll. 1877.
49. STERNOPYGUS VIRESCENS Valenci.
Coll. 1873-1877.
50. STERNOPYGUS TROSCHELII Kaup.
Coll. 1877.
51. STERNOPYGUS MACRURUS Bl. Schn.
Coll. 1877.

CHARACINIDÆ.

52. ANODUS MELANOPOGON, sp. nov.

Char. Gen. Jaws edentulous; abdomen not serrate. Branchial fissures very extensive. Branchial arches furnished with long rakers, which are present on the fifth arch as well as the others.

This genus is *Curimatus* with a clupeiform branchial apparatus. In both the species the rakers on the anterior four arches are bristle-like, while those on the fifth resemble somewhat the pharyngeal teeth of *Catostomide*, although flexible.

This genus has never been distinguished from *Curimatus* until the present time. It is not unlikely that the second species included by Spix in *Anodus* (*An. latior*) is a *Curimatus*, but the *A. elongatus* must be regarded as the type of the genus. Cuvier established *Curimatus* on the *C. cyprinoides* (*Salmo edentulus* Bl. fide Gthr.) but included in it erroneously the *Anodus elongatus*, in which he is followed by Günther.

Since the above was written I learn that Professor Gill has described this genus under the name of *Elopomorphus*, in a recent number of a popular journal.

Char. Specif. General form slender, head elongate, and with acuminate muzzle, with the mandible projecting, beyond the premaxillary border. Length of head entering total without caudal fin, three and two-thirds times; depth of body at dorsal fin, less than one-sixth of the same. Eye large, one sixth of length of head entering one and one-fourth times into length of muzzle and interorbital space, which are thus equal. Opercular bone as long as deep; interoperculum large; extremity of maxillary extending a little beyond vertical line from anterior rim of orbit.

Radii; D. 1 10; A. 1. 10; V. 11; P. 19. Base of first dorsal ray 3 mm. nearer end of muzzle than base of dorsal fin, pectoral fin reaching half way to ventrals, and ventrals half way to anal. The scales are small, in about 128 transverse rows, and at the origin of the anal fin in 23 longitudinal rows. The origin of the ventrals is below the middle of the dorsal fin. Total length M. .075.

Color blackish above and one-third way down the side; sides and abdomen, with sides of head silvery. Dorsal and caudal fins dusky and without spots. End of mandible black.

Coll. of 1873; numerous specimens.

53. ANODUS STEATOPS, sp. nov.

While the preceding species has rather clupeiform character, the present one looks like a *Hemiodus*, and particularly the *H. microlepis*, with which it was found associated in the collection. It differs much from the *H. melanopogon* in the even lips, and the extensive adipose membrane which closes the eye to an even greater degree than is found in the *H. microlepis*, reducing it to a vertical fissure. Radial formula D. I. 10; C. 3 + 19 + 3; A. I. 11; V. 12; P. 19, reaching half way to ventrals; ventrals reaching half way to vent. The ventrals originate below the middle of the dorsal fin, which originates exactly half way between the end of the muzzle, and

the base of the superior caudal fulcra. Scales small, $\frac{13-14}{93}$. The general form is slender, the depth entering the length less the caudal fin 5.3 times; and the length of the head entering the same 3.6 times. The diame-

ter of the eye as seen through its adipose covering is a little less than one-fifth the length of the head; and is one-half the interorbital width measured over the strong convexity of the frontal bone. The maxillary bone makes an angle with the premaxillary, and extends as far as the line of the anterior border of the orbit; the greater part of its length passes beneath the edge of the preorbital bone. The opercular apparatus is elongate, but the operculum is deeper than long. Total length M. .205; length of head .047; length to origin of dorsal fin (axial) .082; do. of ventral .090; do. of anal fin .134.

Color in spirits steel blue, paler below; base of the caudal fin extensively black; other fins unspotted. Sides of head golden; chin and top of head black; a golden speculum above the orbit.

Coll. of 1877.

54. *CURIMATUS ALTAMAZONICUS*, sp. nov.

This is a robust species with small scales. The form is elongate-oval, and the head wide. The pectoral region is not flattened nor covered with roughened scales, while the ventral line from the ventral fins to the vent is keeled, but not serrate. The dorsal fin is elevated, its anterior rays being four-fifths as long as the head.

Radii; D. I. 10; A. I. 12; V. 9; P. 13. The pectorals do not reach the ventrals, nor the latter the vent. The ventrals originate below the fifth dorsal spine. First dorsal ray much nearer the end of the muzzle than the base of the caudal fin. Scales 35-94-22. Depth at first dorsal ray entering length minus caudal fin 2.7 times. Length of head in the same three and two-fifth times. The eye enters the length of the head four and four-fifth times, and twice in the moderately convex interorbital width. Lips equal, the inferior closing within the superior. Maxillary bone short, not extending behind the line of the nares. Color silvery without spots on the body or fins. Total length M. .200; length of head .049; do. to origin of dorsal fin (axial) .070; do. to origin of ventrals .080; to origin of anal fin .124.

This species appears to be nearest the *C. laticor* Spix. judging from descriptions. In that fish the anal rays are said to be 14-15, and the dorsals 12.

Coll. 1873.

55. *CURIMATUS SPILURUS*, Günth. Steind.

Coll. 1873.

56. *CURIMATUS TRACHYSTETHUS*, sp. nov.

This is a moderately elongate species with the preventral region flattened, and covered with large, thick striate and dentate scales; and with the postventral region also flattened, and without distinct median keel. Radial formula D. I 10; C. 2 + 19 + 2; A. I. 8; V. 9; P. 16. The pectorals nearly reach the ventrals, which originate below the middle of the dorsal fin, and reach to the vent. The anal fin has a short basis which is equal to its distance from the vent; folded backwards it reaches the base of the caudal fin. The elevation of the dorsal fin exceeds the length of the head. The depth at the front of the dorsal fin is one-third the length of the caudal; the length of the head is one-fourth the same.

The eye is large, entering the length of the head 3.25 times and the flat interorbital space 1.5 times. The muzzle is flat and projects a little beyond the lower lip. The mouth does not extend to the line of the orbit. The inferior suborbital bone is much longer than the others. Total length M. .128; length of head .026; to base of dorsal .040; of ventral .047; of anal .080. Scales 8-48-6.

Color silver, with bluish reflections above; a bright line along the middle of each row of scales. Fins immaculate except a round spot on the dorsal fin below its middle.

This species is allied to the *C. asper* of Günther, but that fish has smaller scales, more anal rays and other characters. (See Proceed. Zool. Soc. Lon., 1868.)

Coll. of 1877.

57. POTAMORHINA PRISTIGASTER: *Curimatus pristigaster* Steindachner, Sitzungsberichte Akad. Wiss. Wien, 1876, July (separata p. 25), Pl. VI.

This species, well described and figured by my friend Dr. Steindachner, is too distinct from the species of *Curimatus* to remain in that genus, in my opinion. It presents between the ventral and anal fins not only a keel, as in many species of the genus named, but the keel is surmounted by a series of acute recurved spiniform scales, quite unlike the normally formed ones which bound it in the keeled species of *Curimatus*. I therefore propose for it the generic name above written. The spinous processes are stronger in my specimens than in the figure given by Dr. Steindachner.

Coll. 1873.

58. PROCHILODUS ORTONIANUS, sp. nov.

Radial formula D. I. 10; C. 3-19-2; A. III. 8; V. 9; P. 14. Scales 9-44-7. Depth of body at dorsal fin entering the length less the caudal fin $3\frac{2}{3}$ times; Length of head entering the same 3.7 times. Diameter of eye entering head 4.5 times, or one and a half times in the muzzle and two and a half times in the interorbital width. From these figures it is evident that this is a moderately elongate species, with rather elongate and wide head. The frontal region is convex, and the upper lip does not project beyond the lower as in *P. harttii* Steind. The pectoral fins reach the ventrals, but the latter fall far short of the anus. The belly between the latter and the base of the ventral is keeled, but not serrate. The dorsal fin is situated a little in advance of the ventrals, and is quite elevated, equaling the length of the head. Caudal fin rather short and robust. Total length M. .200; length of head .046; do. to base of dorsal (axial) .072; do. to ventral (axial) .083; to base of anal .134; depth of caudal peduncle .020.

Color silvery, above shaded with blackish; the scales at the base of the anal fin inserted in a blackish skin. Dorsal fin with six or seven cross-rows of blackish dots, which only mark the rays. Caudal fin with four cross-bands of rather obscure character, which follow the posterior contour of the fin, except the posterior, which cross the apices. A large specimen, measuring M. .350, is uniform silvery everywhere.

From Nauta, Peru, coll. 1873.

This species is dedicated to the memory of my late friend, Prof. James Orton, as a slight expression of my respect for him as a man, and of my admiration for his fearlessness and energy as an explorer.

59. *PROCHILODUS CEPHALOTES*, sp. nov.

There are several points of affinity to the *P. argenteus* to be observed in the small specimen referred to this species. Radii D. I. 10; A. II. 10; scales 10-? 41-? depth entering length without caudal fin 2.7 times; length of head three times. The head is wide, the interorbital width being half the length, and nearly twice the diameter of the eye. The latter is rather less than the length of the muzzle. The pectoral fins are small, not reaching the ventrals, which in turn do not reach the vent. Dorsal fin with three or four transverse rows of brown spots. General color plumbous; above blackish.

Total length .071; length of head .021; to dorsal fin (axial) .024; to ventral fin .029; to anal fin .045.

The much larger head and the spotted fins distinguish this fish from the *P. argenteus*, which it resembles in scale and fin formula, and depth of body.

Coll. of 1873.

60. *EMIODUS MICROLEPIS* Kner.

Coll. 1873-1877.

61. *RÆBOIDES MYERSII* Gill, Proceed. Acad. Phila. 1870, p. 92.

Radii; D. I. 10; A. I. 48; scales 24-80+5-23. Head entering total length less caudal fin, 2.33 times, and head entering the same, 3.6 times.

Coll. of 1877.

62. *ANACYRTUS SANGUINEUS* Cope, Proceed. Acad. Phila. 1872, 266, Pl. 9, fig. 1.

Coll. 1873.

63. *ANACYRTUS LIMLESQUAMIS*, sp. nov.

A species of robust proportions, distinguished by its small rough scales. The body is rather deep, and the head wide with very convex interorbital region. The depth enters the length less the caudal fin 2.8 times, and the head enters the same 3.7 times. The eye enters the head five times, and the interorbital region over its convexity 2.5 times. Scales 27-112-28; the exposed surfaces covered with minute prickles. Radii D. I. 10; A. I. 41; V. 7; P. 16, reaching beyond the base of the ventrals, which nearly reach the vent. The first anal ray commences below the seventh dorsal ray.

The top of the head is concave in profile, and the jaws are equal. There are two rows of premaxillary teeth, of which the inner consists of very few teeth. One series of mandibular teeth including three canines, of which the middle one is the largest. Two canines in the premaxillary bone, the anterior much the larger. Maxillary teeth numerous. Maxillary bone extending considerably beyond the posterior border of the orbit. Opercular bones narrow.

Color gray, with a broad golden lateral band above the lateral line. In

the anterior part of the latter is a large black spot which is situated nearer the opercular fissure than the line of the first dorsal ray. An indistinct black spot at the base of the caudal fin. Total length M. .220; of head .025; to base of ventral fin (axial) .075; do. of dorsal fin (axial) .088; do. to origin of anal .115.

Coll. 1877.

64. *XIPHORHAMPHUS ABBREVIATUS*, sp. nov.

Form stout and robust, the depth of the ventral fin entering the length minus the caudal fin three and a half times. Length of head entering the same about three times. The muzzle is relatively short, being only one and a half times the length of the long orbit. This enters the head 4.75 times, and the flat interorbital space 1.5 times, which therefore equals the length of the muzzle. There are two distant large canines on the anterior part of the maxillary bone and four smaller ones; the maxillary teeth are minute. There are two distant canines on the premaxillary, and four large ones on the dentary, with a terminal tooth of small size. The maxillary is covered for its entire length by the preorbital, and extends to a half orbits diameter behind the posterior border of the orbit.

Radial formula D. I. 10; A. II. 21; V. 8; P. 16, reaching base of ventrals, which reach vent. Dorsal fin elevated, equaling length of head without muzzle, originating behind line of ventrals, and terminating just in front of line of first anal ray. Scales 25-90 + 3-10, smooth, those of the lateral line not longer than the others. Breast below shoulder girdle, keeled.

Color silvery bluish, with a wide paler shade along the side; a black humeral and basal caudal spot. Fins immaculate, pectorals and ventrals dusky. Total length M. .212; of head .038; to origin of ventrals (axial) .090; do of dorsal .109; do. of anal .130.

Coll. 1873-1877.

65. *XIPHORHAMPHUS HETEROLEPIS*, sp. nov.

An elongate species in which the depth enters the length with the caudal fin six times, and the head enters the same three and six-tenth times, or three and three-tenth times without the caudal fin. The muzzle is narrowed and convex above, and is not so long as from the anterior border of the orbit to the preopercular border. The dorsal fin is in the posterior part of the second third of the length (without caudal fin). Formula; D. I. 10; A. II. 25; V. 8; P. 15, reaching more than half way to ventrals, which extend half way to vent. Scales very small, those of the lateral line larger than the others, and crossed by a vertical ridge beyond their middle: formula 38-121+8-23.

The diameter of the bony orbit enters the head 5 times, and the interorbital space 1.25 times. The front and ethmoid region exhibit a few longitudinal ridges, and there is no rugosity on the epiotics. There are two foramina for the accommodation of two inferior canine teeth on each side. Total length M. .360. The first suborbital bone behind the preorbital, is narrow. Color silvery, on the side golden; a basal caudal, no humeral spot.

Several specimens: colls. of 1873-77.

This species appears to be allied to the *X. falcatus*, from Guiana, as defined by Günther, but this author does not allude to some of its prominent characters. According to his description, that is a stouter species having the depth one-fifth the length, and the head smaller, or one-fourth the same. It has also a humeral spot. All my specimens have 25 anal rays, not 28-30 as given by Dr. Günther.

66. *XIPHORHAMPHUS FALCIROSTRIS* Cuv., Günther.

This species, of which I have two specimens, differs from the last as follows: Anal radii (soft) only 21; dorsal fin in the posterior third of the length minus caudal fin; scales equal, 36-151+8-15. Head and muzzle wider, the latter without ridges above, and with only one foramen for the inferior canines. First suborbital bone wider. It differs from Günther's description in having the muzzle considerably shorter than the distance from the anterior border of the orbit to the preopercular border. I add that the supraoccipital crest is short, and the epiotic region rugose. Depth one-sixth length without caudal fin; length of head in same 3.7 in the same. There is a caudal but no humeral spot. Total length M. .285.

Coll. 1873-77.

67. *HYDROLYCUS PECTORALIS* Günther, Ann. Magaz. Nat. Hist., 1866.

Coll. 1873-77. Nauta.

68. *RAPHIODON VULPINUS* Spix., Agass.

Coll. 1873-77.

69. *RAPHIODON GIBBUS* Spix., A. 75.

Coll. 1873.

70. *XIPHOSTOMA TLEDO* Cope, Proceed. Acad. Philada., 1872, p. 267, Pl. XIII, fig. 2.

Specimens of this species in better preservation than the types, show that the belly is black, and that there is a large black spot on the inferior side of the caudal peduncle at the base of the caudal fin. They also show that all but the anterior portion of the lateral line is wanting. These characters indicate that this is a distinct species from the *X. maculatum* with which it is united by Steindachner. At least they are not found in author's figures and descriptions of the latter.

71. *CHARACIDIUM STEINDACHNERI*, sp. nov.

This, the third species of the genus, is of more slender form than either of the two known hitherto, and has a smaller number of longitudinal rows of scales. The number of transverse rows is as in *C. fasciatum* the type, and larger than in *C. theostoma*. The fin rays are less numerous than in *C. fasciatum*.

Radii; D. 9; A. 7; V. 9; the first ray a little behind the origin of the dorsal fin, and the produced apex of the fin nearly reaching the anal. The pectoral fin is also prolonged, attaining the base of the ventral. The length of the head is greater than the depth of the body entering the length less the caudal fin, 4.33 times. The greatest depth enters the same 6.5 times. Scales 4-37-2 or $1\frac{1}{2}$; $5\frac{1}{2}$ rows on the stout caudal peduncle. Lateral line complete.

The muzzle is acuminate and the mouth very small. The orbit is large, its diameter exceeding the muzzle, and entering the head four times, and exceeds the interorbital width by nearly its half.

The color is plain, with the row of scales bearing the lateral line silvery and without dark borders. There are nine narrow rather weak vertical blackish bars, between the caudal fin and the occiput. Inferior fins unspotted; caudal with a dark shade at the base, and one at the extremity. Total length M. .029; of head, .006; to line of dorsal fin .010; to do. of anal, .018; to basis of caudal .026.

This species is dedicated to my friend Doctor Franz Steindachner, of Vienna, the distinguished zoölogist, who has added much to our knowledge of the fishes of the Amazon. I have derived much instruction in this department from his very full diagnostic analyses.

Coll. of 1873.

72. *APHYCHARAX PUSILLUS* Günth.

Coll. 1873.

73. *SCHIZODON FASCIATUS* Spix.

Coll. of 1877.

74. *SCHIZODON SAGITTARIUS*, sp. nov.

This species is more elongate and slender than any of the known representatives of the genus; the vertical diameters of both head and body being reduced. The extension of length is in the post dorsal region. Length of head into the total, less the caudal fin, a little more than five times; depth of body into the same nearly six times, hence less than length of head. Radii, D. I. 11; C. 2 + 19 + 2; A. I. 9; V. 9; P. 16. Dorsal fin originating anterior to the point marking two-fifths the distance from the end of the muzzle, to the base of the caudal fin; its elevation equal to the length of the head. Pectoral fin not reaching the ventral, which does not reach half way to the vent, and originates below the fourth dorsal ray. Orbit entering the length of the head 4.2 times, and the interorbital width twice; the inferior range of vision is a little greater than the superior. Mouth terminal, the mandible a little longer than the premaxillary, and armed with six teeth. These are smooth externally, and have two principal cusps. The superior are denticulate, the denticles arranged into three cuspidate groups. In both jaws the median teeth are larger than the lateral. Total length, M. .165; length of head .027; length to origin of the dorsal fin .051; do. to origin of ventrals .057; do. line of origin of anal fin .110. Above dusky to second row of scales below the lateral line; below this point silvery. Fins unspotted except the caudal, which has a dark longitudinal shade along the middle of each lobe.

This species is probably allied to the *Rhytidoodus argenteofuscus* of Kner, but in that species according to Kner, the superior teeth have but one point, those of both jaws are keeled externally, and the depth of the body exceeds a little the length of the head. The inferior tooth figured by Kner is entirely unlike those of this fish.

Coll. 1877.

75. SCHIZODON TRIMACULATUS Kner.

Coll. 1877.

76. LEPORINUS VITTATUS Cuv. Val.

Coll. 1877.

77. LEPORINUS FREDERICI Bloch.

Coll. 1877.

78. LEPORINUS HYPSELONOTUS Günth. Proceed. Zool. Soc. London, 1868,
p. 244.

Coll. 1877.

79. LEPORINUS HOLOSTICTUS, sp. nov.

This handsome species is distinguished by the continuation of the very distinct brown cross bands on to the head, the first one covering the end of the muzzle. The depth of the body is about equal to the length of the head, entering the length less the caudal fin four and a quarter times. The orbit is large, its diameter entering the length of the head four times, and the interorbital width one and five-sixth times. Scales 6-41-5. Radii D. I. 11; A. I. 9; V. 10; P. 14, reaching half way to ventrals, which originate below the fourth dorsal ray. There are eight teeth in each jaw; those of the mandible are small, excepting the median pair, which are much prolonged, and acute. The color is silvery, darker shaded above, crossed by seven black cross bars on the body, one additional on the nape, and two on the head. Those on the head are on the muzzle, and between the orbits; the five behind the ventral fins pass entirely round the body. There is in addition a dusky shade at the emargination of the dorsal fin. Fins otherwise unspotted. Length M. .107; of head .026; to line of dorsal fin .049; to base of anal .082; to base of caudal .104.

Coll. 1877.

80. LEPORINUS MULTIFASCIATUS, sp. nov.

Depth of body and length of head sub-equal, and entering the length less the caudal fin 3.66 times. The eye is large, its diameter being a little less than one-third the length of the head, and five-eighths of the interorbital diameter. The length of the muzzle is five-sixths the length of the head posterior to the orbit. Scales 4-36-5. Radii; D. I. 11; A. I. 10. Ventral fin below the fourth dorsal ray; pectoral reaching half way to ventral.

Color brown, with fourteen vertical darker brown bands, the first at the nape, the last near the base of the caudal fin, with its middle interrupted, the interruption being followed by a dark spot. Fins unspotted. Total length M. .065; of head .015; to line of dorsal fin .024; of anal .044; to basis of caudal .055.

No other species presents the numerous cross bands of this one.

81. HEMIGRAMMUS ROBUSTULUS Cope, Proceed. Amer. Philos. Soc. 1870,
p. 561.

Coll. 1873.

82. *TETRAGONOPTERUS HAUXWELLIANUS* Cope, *Proceed. Amer. Philos. Soc.* 1870, p. 560.
Coll. 1873.

83. *TETRAGONOPTERUS CHALCEUS* Agass.
Coll. 1877, from the Marañon.

84. *TETRAGONOPTERUS ORTONII* Gill. *Proceed. Acad. Phila.* 1870, p. 92.
Coll. 1873.

85. *TETRAGONOPTERUS AGASSIZII* Steindachner, *Sitzungsber., K. K. Akad. Wiss. Wien*, 1876 (July) 41, Pl. VIII, fig. 2.

Two specimens from near Pebas resemble the species above named in all points excepting in the more elongate body, so that I suspect them to represent a local race. There are 1.24 anal radii, and the longitudinal rows of scales are 5—1+3—4. The total length without caudal fin is M. .034; depth .013; length of head .0105. The caudal spot is very large, covering the basal half of the fin, while the humeral spot is obsolete.

86. *TETRAGONOPTERUS LONGIOR*, sp. nov.

One of the more elongate forms of the genus. Radii D. I. 10; A. I. 24. Longitudinal series of scales twelve. The greatest depth enters the length less the caudal fin 4.7 times, and the length of the head the same 4.2 times. The diameter of the orbit enters the length of the head 3.5 times, and the interorbital width 1.33 times. The maxillary bone is toothless, and rather wide, and extends little beyond the line of the anterior border of the orbit. The origin of the dorsal fin is behind the line of that of the ventrals, and is nearer the origin of the caudal fin than the end of the muzzle by the length of the latter.

There is a broad silvery lateral stripe, on which is a strong black humeral spot. There is no distinct basal caudal spot. Total length .095.

Coll. of 1874, from Moyabamba.

87. *TETRAGONOPTERUS*, sp. indet.
Coll. of 1873.

88. *TETRAGONOPTERUS*, sp. indet.
Coll. of 1873.

89. *TETRAGONOPTERUS DIAPHANUS*, sp. nov.

An elongate species distinguished by the small number of its anal rays. D. I. 9; A. I. 18; V. 7, originating a little anterior to line of dorsal, and not reaching anal; P. 13, not reaching ventrals. Dorsal fin nearly equidistant between end of muzzle and base of caudal fin. Anterior rays of dorsal and anal fins markedly longer than the posterior. Depth entering length less caudal fin three and one-seventh times; length of head into the same, four and two-fifths times. Scales 4—35—3.5; lateral line complete. Maxillary bone toothless, extending near to the line of the anterior border of the orbit. The latter enters the length of the head 2 and 3—4th times, equaling the interorbital space.

Total length M. .052; of head .011; to line of ventral fin .020; to line of

anal .028. Color silvery, with a broad bright silver lateral band, and no bright spots.

Coll. 1874.

90. TETRAGONOPTERUS IPANQUIANUS Cope, Proceed. Amer. Philos. Soc. 1877, p. 28. Urubamba River; elevation 11,500 feet.

Coll. of 1877.

91. STETHAPRION CHRYSSEUM Cope, Proceed. Academy, Phila. 1872, p. 261.

Coll. 1877.

92. CHALCINUS CULTER Cope, l. c. 265.

Coll. 1873.

93. TRIPORTHEUS NEMATURUS Kner.

Coll. 1872.

94. SERRASALIMO IMMACULATUS sp. nov.

This species belongs to the restricted genus *Serrasalmo*. There are six premaxillary teeth, of which the third is much smaller than the others. Each tooth has a denticle at its posterior base, which in the case of the external tooth is longer horizontally than the principal cusp, and is not apiculate. There are seven in the lower jaw, of sub-equal size, each with a posterior basal denticle, except the anterior, which has two basal denticles.

The form is discoid, the depth entering the length less the caudal fin 1.8 times, and the length of the head entering the same three times. The dorsal and ventral outlines are equally convex, but the steeper slopes are opposite the anterior above, and the posterior below. Scales small 34-100-33. Radii; D. 17; A. I. 32; V. 7, not reaching vent; P. 15, reaching base of ventrals. Spines 33 4. Gill rakers of first arch short, and with short apices. Diameter of eye entering length of head (including chin) five times; and nearly twice in the interorbital space measured over its convexity. The origin of the dorsal fin is above the ventral, and equi-distant between the base of the superior marginal ray of the caudal fin and the posterior border of the orbit. The superior caudal rays are not so long as the inferior. Second sub-orbital bone as high as long. Muzzle a little longer than diameter of orbit. The color is silvery without distinct spots; in certain lights numerous small lead-colored spots may be detected on the dorsal region, extending half way down to the lateral line. Caudal and anal fin broadly black bordered, no yellow band. Total length M. .190; of head .055; to line of dorsal fin .090; to line of anal .116; to basis of marginal caudal rays .161.

This species is near the *S. usopus* Cope, but is readily distinguished by the much more numerous scales, and the longer muzzle.

Coll. of 1877.

95. METYNNIS LUNA, gen. et. sp. nov.

Char. Gen. This is *Myletes* with an external horizontal cultriform spine at the base of the dorsal fin as in *Serrasalmo* and *Stethaprion*. The premaxillary teeth are in two series, and have an oblique, more or less in

conspicuous cutting edge, as in *Myletes*. Two conical teeth behind the mandibular series. The belly is armed with spiniferous ? interhæmal bones.

This form is related to *Myletes* precisely as *Stethaprion* is to *Tetragonopterus*. But one species is known to me.

Char. Specif. Form orbicular, the dorsal region very convex; the abdominal outline still more so. The depth is eleven-twelfths of the length less the caudal fin, and the length of the head enters the latter three and two-tenth times. The depth of the head from the superior border of the post-temporal bone equals the length. The eye is large, entering the length of the head three and one-sixth times, and the convex interorbital space one and one-half times. The chin projects a little beyond the premaxillary border, and the end of the toothless maxillary bone is immediately below the proximal extremity and below the nostrils.

Radii; D. I. 17; A. 39; V. 7; P. 14. The ventral fins are very small, and their base is contracted, so that the spines are arranged nearly in a circle, the inner and outer being of equal length. The pectorals are small, marking only the third of the distance to the line of the ventrals. The base of the anal makes an angle of only 25° with the vertical; its anterior rays are little prolonged. The base of the dorsal is oblique downwards and backwards, and the first ray marks a point at .4, the distance between the bases of the pectoral and ventral fins. The length of the base of the adipose dorsal is two thirds that of the rayed dorsal. Ventral spines 25, the anterior recurved and simple, the posterior more or less bifurcate. The head of the predorsal spine is anvil shaped. The suborbital bones are narrow; the anterior is the widest, and is triangular with the long apex superior.

Scales between the lateral line and the ventral fins, 39-40, those of the lateral line (in front) larger than the others. Total length, M. .075; of head, .020; to line of ventral fin, .033; of anal, .046; of caudal fin, .060. First dorsal ray equidistant between base of caudal marginal ray and end of muzzle, measured in straight lines. Color golden, excepting the superior half of the region above the lateral line, which is dove-color in spirits. No spots of any kind.

Coll. of 1877.

96. *MYLETES HERNIARIUS* Cope, Proceed. Acad. Phila. 1872, p. 268.

Coll. of 1873.

The specimen here recorded differs slightly from the type in some details. Dorsal radii in both, 17; anal in type, 32; in new specimen, 35; spines in type 46; in new specimen 51. There is a faint eye-like spot on the side in the new specimen, not seen in the type, and some indistinct vertical shades.

Coll. of 1873.

97. *MYLETES NIGRIPINNIS*, sp. nov.

Premaxillary teeth in two series, which are in close contact. The anterior series is curved, and consists of ten teeth with a space as wide as a tooth in the centre; the posterior series is uninterrupted, and consists of

four teeth. The mandibular series is uninterrupted, and consists of seven teeth on each side, the posterior four being much smaller than the others. The two posterior mandibulars are in contact with the median pair of the anterior series, and are separated by a narrow interspace from each other.

The general form is broadly rhombic. The depth is one-half the length with the caudal fin, and the length of the head enters the same three and one-half times. Radii ; D. I. 15 ; A. 23 ; V. 8 ; P. 16. The inferior paired fins are very short ; the others are well developed. The adipose fin is furnished in its superior part with *jointed rays*, the inferior portion is scaly. The base of the anal fin is covered with minute scales. The origin of the first dorsal ray is a little behind that of the ventral fin, and the anal begins under the last third of the former. Ventral spines 46, all simple and recurved. Scales 26—65+6—21 ; the lateral line considerably decurved behind the head. The head is wide and depressed above the orbits. The latter enter the length of the head 4.5 times ; the inter-orbital space 2.5 times, and the muzzle once, axially measured. The frontal region is moderately convex in cross section. The mandibular teeth close within the premaxillaries, and the upper jaw projects beyond the mandible. The lips are equal, however, in consequence of the thickness of the lower, which fills the space. Its superior surface is papillose, and at the points where it comes in contact with the maxillaries it is continued as a free beard on each side, reaching to below the centre of the nares when extended. The maxillary is folded under the preorbital, but its posterior border cannot reach the line of the anterior border of the orbit.

Total length. M. .130 ; of head, .040 ; to line of dorsal fin, .055 ; to line of anal, .079 ; to base of caudal fin, .103. Color silvery, plumbeous above ; the sides marked with rather large round plumbeous spots. A silver band on each side of the ventral spines. Anal fin, caudal, except superior and inferior border, and terminal halves of paired fins, black. Dorsal dusky.

In a larger specimen, probably from Nauta (230 mm.), the scales are finely ctenoid, those at the bases of the median fins coarsely so. The head is furnished with minute rugosities, and there are no labial beards nor color spots.

Coll. 1873—1877.

98. *MYLETES BIDENS* Spix.

Coll. 1873.

99. *MACRODON TRAHIRA* Spix.

Coll. 1873-77.

100. *ERYTHRINUS SALMONEUS* Gron.

Coll. 1873-77.

101. *ERYTHRINUS BREVICAUDA* Gthr.

Coll. 1873.

102. *PYRRHULINA ARGYROPS*, sp. nov.

Radii ; D. I. 9 ; A. I. 9. Scales in seven longitudinal, and about twenty-

five transverse series. The scales are lost from the anterior part of the body in two specimens, so that the number given is not absolutely certain, but very probable. Origin of dorsal fin immediately above that of ventral, and exactly half way between the base of the superior marginal ray of the caudal fin and the anterior border of the orbit. Pectorals not reaching the rather large ventrals, which fall considerably short of the anal. Head in total length less caudal fin, four and one-sixth times, and equal depth of body at dorsal fin. Eye large, its diameter entering length of head three times, exceeding muzzle by nearly half, and entering interorbital space 1-5 times. Suborbital bones reaching pre- and interoperculum. The mandible projects, and the maxillaries are very short and subdiscoid, closing into an external concavity at the base of each ramus. Color olivaceous, except a silver spot at the center of each scale. Fins unspotted, except the dorsal, which has a large black spot over its middle portion, no black band on head, which is silvery on the sides.

Coll. 1877.

ISOSPONDYLLI.

OSTEOGLOSSIDÆ.

103. OSTEOGLOSSUM BICIRRHOSUM Vand.

Coll. 1873.

104. ARAPLEMA GIGAS Cuv.

Probably Nauta, 1873.

HAPLOMI.

CYPRINODONTIDÆ.

105. RIVULUS MICROPUS Stein., Gthr.

Coll. 1873.

SYNENTOGNATHI.

BELONIDÆ.

The genus *Belone* must be placed in a family group distinct from that which includes the genus *Exocoetus* and its allies. I have already pointed out the fact that it possesses a distinct coronoid bone; in addition to this, the vertebrae display zygapophyses, a character unusual among fishes. On these two characters I propose the family *Belonidæ*. Professor Gill has already created this name, but he did not define the group to which he applied it.

106. BELONE TENIATA Günther.

Coll. 1873-77.

PLECTOGNATHI.

TETRODONTIDÆ.

107. TETRODON PSITTACUS Bl. Schn.

Coll. 1873.

PERCOMORPHI.

CHROMIDIDÆ.

108. HEROS AUTOCHTHON Gthr.

This species is stated by Dr. Steindachner to be confined to the coast

rivers of Brazil, and not to occur in the valley of the Amazon. I cannot distinguish my Peruvian specimens from the descriptions furnished by him and by Dr. Günther.

Coll. 1877.

109. *HEROS BIMACULATUS* Linn. Cope; *Acara* Gthr.

Coll. 1873-77.

110. *ACARA FLAVILABRIS* Cope, Proceed. Amer. Philos. Soc, 1870, p. 570.

Proceed. Acad. Phila. 1872, Pl. XI, fig. 4.

Dr. Steindachner in the Sitzungsberichte of the Vienna Academy for 1875, p. 6 (*separatu*), expresses the opinion that this species is the *A. tetramerus* Heck., basing it on a presumed error on my part in the counting of the scales on the cheek. He finds my figure above cited to disagree with my last description, in possession of three rows of cheek scales while I have stated that only two exist. An examination of numerous specimens additional to those already in my possession, shows that they only exhibit two rows of cheek scales as I have described. Dr. Steindachner has evidently misunderstood my figure, for there are but two rows of cheek scales represented on it as described. The third row belongs to the inferior limb of the operculum. The figure only is defective in the dark shading of the inferior lip, which is yellow in life.

Coll. 1873.

111. *ACARA SYSPILUS* Cope, Proceed. Ac. Phila. 1872, p. 255, Pl. XI, fig. 3.

In a larger specimen of this species than the type, the body is relatively deeper, and the eye a little smaller, and the vertical bands are less decided.

Coll. 1877.

112. *ACARA SUBOCULARIS*, sp. nov.

Radii D. XIII, 11; A. III, 8; V. I. 5, nearly reaching vent, and originating below the fourth dorsal spine. Scales 3-30-2-8-9; on cheek five rows. Form rather elongate; head not robust, its length entering the total less the caudal fin 3.4 times. The depth at the ventral fin enters the same 2.75 times. The preorbital bone is as wide antero-posteriorly as the orbit, and exceed the interorbital space by 1 mm. The orbit is thus behind the middle of the head, into whose length it enters 3.6 times. Its superior rim is in the frontal plane. The fourth and longest dorsal spine is as long as the cranium from the superior extremity of the branchial fissure to the anterior border of the orbit. The profile descends from the supra-occipital crest in a nearly straight line, with a slight concavity at the front of the orbit.

Color light brown, with a narrow vertical black spot just below the lateral line opposite the middle of the ventral fin. A black spot on the upper anterior portion of the spinous dorsal fin. A vertical black band from the eye to the inferior edge of the preoperculum.

Total length M. .075; of head .017; to basis of ventrals (axial) .022; to basis of anal .039; of caudal .058; depth .021.

This species resembles the *Geophagus cupido*.

Coll. of 1877

113. ACARA HYPOSTICTA, sp. nov.

Radii; D. XIII 19; A III 15½. Scales 6—30—3—17—8; six rows on cheek. The ventral fins commence under the third dorsal spine. The longest (fourth) dorsal spine is equal to the diameter of the bony orbit, which nearly equals the flat interorbital space. The preorbital bone is as long antero-posteriorly as one-third the diameter of the orbit, which is one-third the length of the head, exceeding a little the length of the muzzle. The extremity of the maxillary bone extends a little beyond the line of the anterior border of the orbit.

The form is a moderately wide oval, with the profile from the base of the dorsal fin a perfectly straight line to the end of the muzzle. The depth at the ventral fins enters the length less the caudal 2.1 times, and the length of the head enters the same 2.6 times. Total length M. .095; of head, .027; to origin ventrals, .031; of anal, .049; of caudal, .070.

The single specimen in my possession is in rather bad condition. It is of a light brown color, the dorsal, caudal and anal fins with brown spots. The ventrals are cross-banded with deep brown; and anterior to them, five similar bands, separated by silvery interspaces, cross the inferior surface, the anterior three of which rise to the superior border of the inferior ramus of the preoperculum. A brown horizontal line extends posteriorly from the mouth.

The soft radii of the median fins are more numerous in this than in any of the described species. This character, with the peculiar coloration, will distinguish it from all of them.

Coll. of 1873.

114. ACARA OCELLATA Agass. (Steind.) *Hydrogonus* Gthr.

Coll. 1877.

115. GEOPHAGUS CUPIDO Heck.

116. GEOPHAGUS TENIATUS Gthr.

Two specimens; one of which exhibits a deep brown band along the middle line of the abdomen, which is wanting in the other.

A third species from Pebas, the *Geophagus badiipinnis* Cope, is thought by Dr. Steindachner to be a *Chatobranhus*. It has, however, the branchial structure of the genus to which I referred it.

117. CICHLA OCELLARIS Bl.

Probably Nauta 1873.

118. CRENICICHLA PROTEUS Cope, Proceed. Acad., Phila. 1872, p. 252.

Coll. 1877.

119. CRENICICHLA LUCIUS Cope, Proceed. Amer. Philos. Soc., 1870, p. 570.

Coll. 1873. From the Cachyiacu, an affluent of the Huallaga, near Moyabamba.

120. CRENICICHLA JOANNA Heck.

Coll. 1877.

GENERAL OBSERVATION.

The 121 species enumerated in the preceding pages are distributed among the following natural families.

Symbranchidæ.....	1
Hypophthalmidæ.....	2
Siluridæ.....	36
Aspredinidæ.....	2
Sternopygidæ.....	10
Characinidæ.....	52
Osteoglossidæ.....	2
Cyprinodontidæ.....	1
Belonidæ.....	1
Tetrodontidæ.....	1
Chromididæ.....	13

 121

The preceding families have all been known heretofore as occurring in the fresh waters of South America, so that an analysis of the contents of this catalogue must relate chiefly to the genera and species. In so doing I first point out two genera which are characteristically marine, which have been shown by Günther and Steindachner to inhabit the Brazilian Amazon. I have proven that their distribution extends even to the Peruvian Amazon, 2500 miles from the sea. They are :

I. *Belone* L. *Tetrodon* L., represented by one species each.

I next enumerate four species which are confined to the Alpine waters of the Amazon, having been brought by Prof. Orton from the elevations of from 10,000 to 11,400 feet. These are :

II. *Arges sabalo*, C. V.

Trichomycterus dispar Tsch.

Trichomycterus gracilis C. V.

Tetragonopterus ipanquianus Cope.

These represent the two families of *Siluridæ* and *Characinidæ*, which are distributed everywhere in the neotropical realm. Of the *Characinidæ*, *Tetragonopterus* is universally distributed. Of the *Siluridæ*, *Arges* is Alpine, but whether found in the waters of the Pacific Slope as well as the Atlantic, I am not informed. The other genus, *Trichomycterus*, is Alpine and West Coast, occurring from Equador to Southern Chili. The two species enumerated above are the only ones from Atlantic waters yet known. This is one of the few cases where a West Coast form crosses the great water-shed. It is well known that many genera are common to the waters of both coasts, and even, according to Günther, the species *Marodon trahira*.

I next note the genera which have so far not been found on the lower or middle Amazon, and which may be regarded as characteristic of the Peru-

vian portion of its course. This list is obviously only provisional, as exploration of the Amazonian basin has not progressed sufficiently to enable us to assert the restricted distribution of any type. Thus the genus *Otocinclus* Cope, first obtained from the Peruvian Amazon, has been ascertained by Steindachner to occur near Rio Janeiro. *Zathorax* and *Triportheus* first determined from western species, occur on the Lower Amazon. The genera remaining are :

III. *Siluridæ*; *Brochis* Cope; *Chenothorax* Cope; *Physopyxis* Cope; *Agamyxis* Cope; *Pariolius* Cope.

Characiniidæ; *Aphyocharax* Gthr.; *Iguanodectes* Cope; *Stethaprion* Cope.

Finally, the species which have not yet been found below the Peruvian boundaries are as follows. I include species previously described by myself from Pebas, in the essay on The Fishes of the Ambyiacu River,* also those described by Gill from Orton's first collection, and by Günther from those of Bartlett,

IV. <i>Siluridæ</i>	44	Anacyrus Gthr.....	3
<i>Pseudorhandia</i> Blk.....	1	<i>Xiphorhamphus</i> M. T.....	2
<i>Pimelodus</i> Lac.....	4	<i>Hydrolycus</i> M. T.....	1
<i>Euanemus</i> M. T.....	1	<i>Xiphostoma</i> Spix.....	1
<i>Epapterus</i> Cope.....	1	<i>Characidium</i> Reinhd.....	2
<i>Anchenipterus</i> C. V.....	3	<i>Aphyocharax</i> Gthr.....	2
<i>Centromochlus</i> Kner.....	1	<i>Schizodon</i> Agass.....	1
<i>Doras</i> Lac.....	1	<i>Iguanodectes</i> Cope.....	1
<i>Zathorax</i> Cope.....	2	<i>Odontostilbe</i> Cope.....	1
<i>Agamyxis</i> Cope.....	1	<i>Leporinus</i> Spix.....	3
<i>Physopyxis</i> Cope.....	1	<i>Hemigrammus</i> Gill.....	1
<i>Dianema</i> Cope.....	1	<i>Brycon</i> M. T.....	4
<i>Brochis</i> Cope.....	2	<i>Tetragonopterus</i> Cuv.....	6
<i>Chenothorax</i> Cope.....	2	<i>Triportheus</i> Cope.....	1
<i>Gastrodermus</i> Cope.....	5	<i>Stethaprion</i> Cope.....	2
<i>Hypoptopoma</i> Gthr.....	3	<i>Chalceus</i> Cuv.....	1
<i>Otocinclus</i> Cope.....	1	<i>Serrasalmo</i> Lacep.....	2
<i>Liposarcus</i> Gthr.....	3	<i>Metynnis</i> Cope.....	1
<i>Plecostomus</i> Art.....	3	<i>Myletes</i> Cuv.....	3
<i>Chaetostomus</i> Heck.....	5	<i>Pyrrhulina</i> C. V.....	1
<i>Pariolius</i> Cope.....	1	<i>Holotaxis</i> Cope.....	2
<i>Trichomycterus</i>	2	<i>Chromididæ</i>	10
<i>Aspredinidæ</i>	3	<i>Acara</i> Heck.....	6
<i>Bunocephalus</i> Kner.....	2	<i>Geophagus</i> Heck.....	1
<i>Dysichthys</i> Cope.....	1	<i>Crenicichla</i> Heck.....	3
<i>Characiniidæ</i>	53		
<i>Anodus</i> Spix.....	2		
<i>Curimatus</i> Cuv.....	5	Total number of species not yet	
<i>Prochilodus</i> Agass.....	2	known below the Peruvian	
<i>Ræboides</i> Gthr.....	3	Amazon.....	120

*Proceed. Philada. Academy, 1872.

ADDENDUM

PERCESOCES.

MUGILIDÆ.

GASTROPTERUS ARCHEUS, Gen. et. sp. nov.

Char. Gen. A broad band of teeth on the premaxillary and dentary bones, and a patch on the vomer. Dorsal spinous fin with four rays. Ventral fins abdominal. Second dorsal opposite to anal. Dermal fold not crossing superior portion of premaxillary region, hence the jaws are only partially protractile.

This genus is an interesting form, probably of *Mugilidæ*, related to *Protistius* Cope, and *Myxus* Günther. The wide bands of teeth, consisting of numerous series, are not found in the last named genus, but belong to the first. Here, however, the spinous dorsal fin is rudimental, and there are no teeth on the vomer.

The pectoral fin has the elevated position usual in the *Percesoces*, but the ventral fin is more posterior than in *Mugil*, having the position usual in *Physostomus* fishes. The spinous dorsal fin is very small, and the caudal fin is forked. A lateral line of pores extends along the lower part of the side.

The characters of this genus render it probable that *Protistius** should be referred to the *Percesoces*. These forms add to the number of existing relationships between the cold blooded vertebrate faunæ of Australia and the West Coast of South America.

Char. Specif. Radii. D. IV. I. 11; A. I. 15; V. I. 5; P. 15. The dorsal spines are very small, the first about as long as the diameter of the orbit, and originating above a point half way between the bases of the ventral and anal fins. The pectoral fin is wide, and extends three quarters way to the base of the ventral. The latter extends three-fifths the distance to the anal fin. The anterior rays of the anal are much longer than the posterior, and the margin is concave. Caudal lobes sub-equal and acute. Scales, counting from spinous dorsal to ventral fin: 20-93-3. Anterior to the ventral fin the scales become smaller and rather irregular along the lateral line. Between the occiput and first dorsal spine there are 50 rows. The top of the head is sealed to the line of the anterior borders of the orbits.

The muzzle is prominent and parabolic in outline, projecting very little beyond the mandible. The outline of the latter is similar to that of the muzzle, and the mouth is horizontal to a point a half the eye's diameter in front of the orbit, where it is cut off by the decurvature of the premaxillary bones. Orbit one-fifth the length of the head, and 15 times in length of muzzle, which is one mm. less than the slightly convex interorbital space. The length of the head enters the total minus the caudal fin, four times; the greatest depth of the body enters the same, six times. Total

length M. .166; of the head, .035; to origin of ventral fin, .063; of anal fin .090; of second dorsal fin, .096; of caudal fin, .141.

Besides the generic characters mentioned, this species differs from the *Protistius semotilus* of the same region, in the larger number of soft rays, the smaller eye, narrower interorbital space, etc. The lateral line is better defined in this species, but is not continued beyond the anal fin; a few isolated tubes occur on scales on other parts of the sides.

The color of the *Gastropterus archaicus* is silvery, darker shaded on the upper surfaces, and without spots on the body or fins.

Two specimens; coll. of 1874; obtained by Prof. Orton, at Arequipa on the Pacific slope at an elevation of 7500 feet.

Radiation and Rotation.

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(Read before the American Philosophical Society, June 21, 1878.)

Among the most interesting of the unsolved astronomical problems, are the questions as to the origin of solar radiation and of cosmical rotation. These two problems, as I have already shown, are intimately connected, at the centre of our system, by the ultimate equality which exists between the velocity of light, the limiting centrifugal velocity of solar rotation, and the velocity of complete solar dissociation.

It has been commonly assumed that physical forces tend to ultimate equilibrium and consequent complete stagnation. The imperfections of any plan which looks to such a final result, have led some writers to suppose that there may be some compensating provisions, hitherto undiscovered, for a renewal of activity. In the search for such provisions, the equality of action and reaction and the possibility that the compensation is continually furnished, by Him who is ever "upholding all things by the word of His power," seem to have been wholly overlooked.

If we assume the existence of a luminiferous aether, whether as a reality, or as a convenient representative of co-ordinated central forces, its undulations, when obstructed by inert centres, would necessarily lead to such phenomena as those of gravitation, light, heat, electricity, magnetism, etc. Confining ourselves for the present to the action of gravitation, it is well known that the limiting velocity of possible gravitating action and consequent centrifugal reaction, at any given point, is $\sqrt{2gr}$, the velocity varying as $\sqrt{\frac{1}{r}}$.

If, according to the hypothesis of Mossotti, each particle is provided with a